TRAPPING EXPERIMENTS WITH THE GERMAN COCKROACH, BLATTELLA GERMANICA (L.) (DICTYOPTERA: BLATTELLIDAE), SHOWING DIFFERENTIAL EFFECTS FROM THE TYPE OF TRAP AND THE ENVIRONMENTAL RESOURCES

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Abstract.—Trapping experiments with the German cockroach, Blattella germanica (L.), tested (1) the comparative attractiveness of food vs. water in areas of a laboratory with differences in the availability of these resources and (2) the comparative catch from roatel vs. mason jar-type traps. Cockroaches tended to enter the trap offering the resource which was scarcest within the immediate area of the harborage. The two types of trap showed similar results for all age classes except small nymphs. The roatel caught about four times as many small nymphs as the jar type.

In the course of some twenty years of rearing cockroaches, we have noted certain places in the Cockroach Stock Center laboratory where it is not uncommon to find German cockroaches, *Blattella germanica* (L.). The nature of our rearing and research programs prohibits the use of insecticides to control such infestations. Therefore, traps are used regularly to reduce density and prevent the spread of cockroaches. This situation was utilized recently to investigate suspected differences in the effectiveness of traps, both with respect to baiting with food vs. water and the type of trap. The results of the two experiments reported here have implications for the use of traps to sample populations for purposes of density estimation, analyses of age structure, or other population parameters.

Two infested areas were used as trapping sites. These were at opposite ends of the laboratory, separated by ca. 10 m. Visual observation (sightings) indicated the larger infestation was around the sink, where water was available continuously but food was scarce. The other site was in an area where maintenance activities are conducted routinely (feeding, watering, changing rearing jars, etc.). Here access to water was, at best, sporadic, but bits of dog food are present in difficult to clean places which almost certainly pro-

Trapping Site	Bait	Collection Period	Number of Cockroaches			
			Adults	Nymphs	Tota	
Site 1	Dog food	1st wk	14 (89)	80	94	
		2nd wk	10 (4 9)	98	108	
		2 wks	24 (12 ♀)	178	202	
	Water	lst wk	0	0	0	
		2nd wk	0	1	1	
		2 wks	0	1	1	
Site 2	Dog food	lst wk	3 (2 ♀)	14	17	
		2nd wk	0	6	6	
		2 wks	3 (♀)	20	23	
	Water	1st wk	2	70	72	
		2nd wk	0	18	18	
		2 wks	2	88	90	

Table 1. Comparison of the attractiveness of food vs. water to German cockroaches in two environmentally different sites.

vided some opportunity for feeding. The trapping site at the sink is referred to herein as "site 1" and that in the maintenance area as "site 2."

The traps were either roatel traps (Cornell Chemical Co.) or a homemade mason jar type (1.5 l). In the former, access was by several one-way entrances at floor level. In the latter, paper towels, held in place around the outside of the jar with rubber bands, made it possible for the cockroaches to climb the jar. Once inside, escape was prevented by a thin layer of vaseline[®] around the upper inside jar rim. Bait consisted of water (vial stoppered with sponge), dog food pellets, or both.

The first experiment tested the comparative attractiveness of food vs. water to cockroaches within the two areas. One roatel trap baited with dog food and a second with water were placed at site 1 and site 2. The traps were replaced by clean, freshly baited traps on Monday, Wednesday, and Friday during two successive weeks. The trapped cockroaches were counted and categorized as to adults vs. nymphs. The results are summarized in Table 1. In the sink area (site 1), food was attractive; water was not. At site 2, cockroaches were attracted to both traps, but water proved to be the greater lure. The only dead cockroaches among those trapped at either site were in the food-baited traps at site 2. Apparently these cockroaches were physiologically in critical need of water. A comparison of total numbers caught at each site verified visual observations in that the heavier infestation was clearly in the sink area (site 1), not unlike the situation in apartments or single homes. The second weekly catch at site 1 equalled that of the first, indicating trapping had had little effect on population density. However, at

Turn of	Collection Period	Number of Cockroaches					
		and a second	Nymphs				
Trap		Adults	L	М	Sm	Total	
Roatel	2 wks	29	33	36	127	235	
	2 wks	34	16	24	55	129	
Jar	2 wks	30	44	45	29	148	
	2 wks	25	36	37	15	113	

Table 2. Collections of German cockroaches from roatel vs. jar-type traps. Nymphs grouped as large (L), medium (M), and small (Sm).

site 2, the catch within both types of trap during the second week was markedly less than that of the first week.

The second experiment utilized the heavier infestation at site 1 to compare catch from the roatel to that of the jar-type trap. One of each was baited with food and water. The traps were placed side-by-side at site 1. Collecting procedures were similar to the first experiment except that the nymphal cockroaches were grouped as "large" (primarily 5th-6th stage), "medium" (mainly 3rd-4th stage), and "small" (primarily 1st-2nd stage). This experiment was replicated once. The results are summarized in Table 2. Catches were similar for all age groups except small nymphs. With the latter, about four times as many were caught in the roatel as in the jar trap. Possibly due to the combined effects of double trapping and the continuance of trapping over a longer period, a tendency towards reduced catch finally appeared during the second two weeks of trapping. Apparently trapping was beginning to have an effect on density of the site 1 infestation. The similarity between the number of "medium" and "large" nymphs from all collections is of interest. Apparently there was little mortality among middle or late stage nymphs. The larger numbers of small nymphs, as revealed by roatel traps, probably indicate high mortality among very young nymphs. It also shows how easily heavy infestations of small nymphs could be missed in survey trapping.

To a large extent, the experimental results demonstrate environmental effects that might be predicted by anyone familiar with the German cockroach. Due to the more limited resources, especially with respect to water, the infestation at site 2 was smaller than that at site 1. Scarcity of food, water, or both has been shown previously to affect oothecal formation and nymphal survival (Mueller, 1978). The present experiment showed that cockroaches are attracted to whichever trap offers the resource that is scarcest within their immediate environment. Thus, within kitchens, it is hardly surprising that Ebeling et al. (1966) found removal of food from feeding stations was followed by increased catch in food-baited traps. Another implication from the present results concerns water. It could be a useful addition to food in traps in bedrooms or other situations where water is not readily available. It is noteworthy that jar and roatel traps gave closely similar results for all age groups except small nymphs. Apparently small nymphs were either less willing or able to scale the vertical distance necessary to reach the top of the jar than were those of later stages.

ACKNOWLEDGMENTS

Special thanks are due Nancy Boles and Elizabeth Watson for placing the traps and recording the catch. Also, appreciation is expressed to D. G. Cochran for critical reading of the manuscript and to the Office of Naval Research for support under Contract N00014-77C-0246.

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